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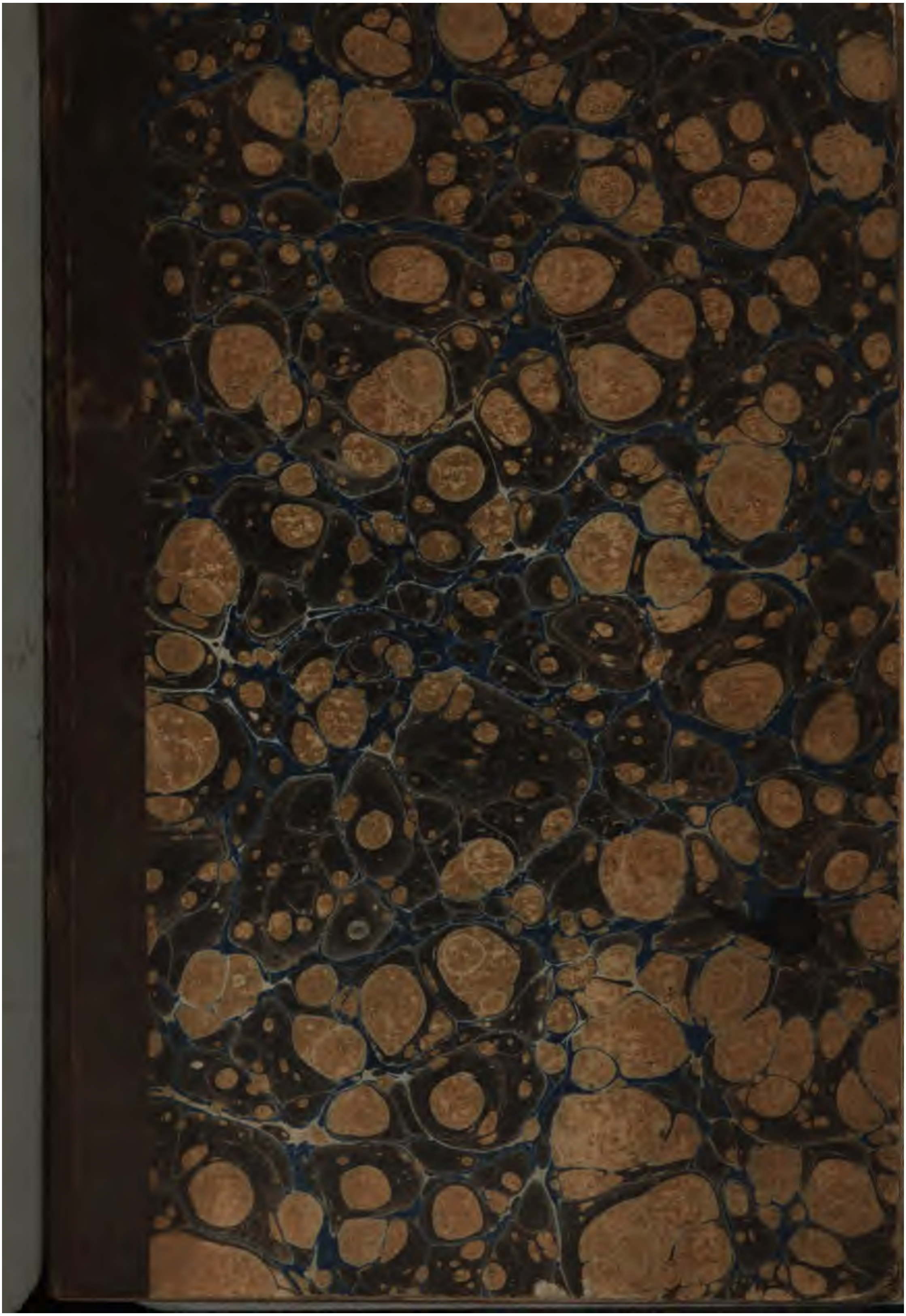

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AN ESSAY

ON

THE ART OF FLYING,

WITH

AN INDICATION

OF THE

MATERIALS BEST ADAPTED FOR WINGS.

(*Date*, 1839.)

> "Bright-eyed Fancy hovering o'er,
> Scatters, from her pictur'd urn,
> Thoughts that breathe, and words that burn."—*Gray*.
>
> "Dulce est desipere in loco."

BY
CHARLES CLAUDE HAMILTON,
(*Formerly of Crebilly, County of Antrim*),
AUTHOR OF LEIGH'S ROAD-BOOK OF IRELAND, AND SEVERAL WORKS ON HISTORY,
GEOGRAPHY, AND EDUCATION.

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AN ESSAY,

&c.

It is an incontrovertible fact that the nineteenth century is already, before half its current era has elapsed, as brilliant in important discoveries of science, as any of the most famous periods, either of antiquity or modern times, in which man has applied his reasoning faculties in a way to distinguish him as the greatest creation of the Almighty. The powerful sun has its prescribed law of action; the versatile and coursing elements derive all their fluctuations from influences of the heavenly bodies;—although their ministrations are uncontrollable, it can scarcely be said, even of them, that there is any thing new within the vast canopy of heaven. The Deluge has left universal traces of its sublunary ravages, and physical evidences demonstrate that no other flood can ever surpass what has been. A volcanic outbreak may rage with greater impetus, and a wider waste, than has been hitherto recorded; this agent may yet teach the world some awful and unknown lessons, but such will be only in the line of destruction. On the contrary, the mind of man may continue to effect, as it has often effected, new things, by permission of God, for good purposes. This is the true nature of invention.

The energy and perfection of modern inventions surpass the most celebrated of those of the ancients, when reason was in her youth, unshackled by the prejudices which the prescription of what *is* must ever encumber genius with, as to all our relations with the *future*. Mankind have forged the links of those chains which bind their race. The principle among the Medes, that laws should be unalterable, was fraught with a freezing influence upon the progress of sound legislation, and upon the moral amelioration of the Eastern world. The inviolability of Indian castes, whereby men were limited to such exertions of intellect, and practice of the useful arts, as each family had antecedently engaged in, was a virtual ban to the genius of those industrious nations; though a known art may have been carried to perfection and polish by an unvarying system. The pertinacity of China, in not permitting institutions which appertained to an infant state of that empire to be infringed on by any comparison with the laws and wisdom of Europe, has, in its evil result, rendered the most populous also the most despicable of nations. The excess to which its rulers have carried this exclusive principle, by repelling all foreigners from that fertile and geographically interesting land, and forbidding all true Chinese subjects to travel abroad, has rendered it but a vast prison to the natives, and has caused the real talent of the laborious Chinese, in manufactures and architecture, to be so hedged in by the thorns of despotism, that their genius, for want of better education, has not created any thing more respectable in the departments of science, than their conservatism in the refusal of international relations and of any participation in the new lights of science (with which travel, a noble and adventurous spirit of commerce, and the communication of ideas, have endowed European society) has done for the multitudinous Chinese, either in laws or in warfare. They are toymakers and nothing beyond: a pagoda is but an item of *quincaillerie.* Their agriculture may be presumed to be despicable, since half the people starve, or feed on nauseous animals. In the art of navigation they do not equal the science of the ancients, which itself was so inferior to that of the moderns.

The above line of argument may be thought to prove nothing with respect to ourselves; for with us an inventor is not only unrestricted, but, to a certain degree, protected by a patent, if he has the means to procure a patent. If, in China, the force of irreversible institutions, devised to uphold the autocratic power of the emperor, and, subordinate to him, the oligarchy of the mandarins, has prevented any thing new in art, science, and inventions, to be there achieved; in like manner, there appears to me an equal difficulty in proposing, carrying out, and rendering palatable to the good-humour of the discerning public, my present invention, with all its combinations and purposes, for there is an apparent absurdity in the very proposal, an overwhelming ridicule to be encountered, and possibly a total disbelief of the physical practicability of the thing proposed, which are fearful and disheartening. The inviolable rules of reason and philosophy, and the influence, on the other hand, of deep-rooted prejudice, are as much against my entertaining a hope of being permitted to advance the plausible evidence of the possibility of carrying this invention into successful practice, as the settled ideas and vested institutions of the Eastern nations have been to the introduction by their native mechanicians of any inventions to equal those of modern Europe. None will deny that the dawn of mechanical science was the effect of the aspiring rays of the genius of invention. The great results of the agency of steam to its destined purposes, that is so astonishing in practical success, were not foreseen, and would not have been credited if they had been all made promise of, when that boundless power was first applied to give motion to machinery.

In treating of so difficult a subject as the art of flying with wings, I have a right to some indulgence. The law of gravitation, the necessity that a human body weighing from eight to twelve stone should fall to the earth from any elevation in the atmosphere, if unsupported, seems to deny that the attempt to fly shall ever be successful. This wild and daring attempt *has* been made by both ancients and moderns, and the causes of failure I purpose to treat of in a detailed historical sketch. These causes of failure are recorded; from the essay of Icarus, son of Dædalus, to the most recent attempts, and until the era when Mongolfier substituted rarefied air in his balloon, instead of giving wings to the shoulders of man. That glorious invention, by its success, in spite of the perils to which aëronauts must ever be exposed, drew off the attention of men from the original purpose of inventing serviceable wings. Yet we are not without some experience in the making of wings; a thousand various conformations of the wings of birds have been presented to the eyes of men by our Creator, and we are not forbidden to attempt the imitation thereof by any moral motive, and are so only by inherent physical difficulties. It is a forlorn hope; and why is it considered such? Simply because the most ingenious attempts have been failures; and the study of flying has been given up, the substances made use of having been either frangible, too weighty, devoid of pliability, and, as in the use of wax, soluble, or without the requisite tenacity. A sufficient combination of proper materials has never yet been imagined for the construction of wings; and the *materials* have been (if I may be permitted to lay down such an axiom) the sole desiderata. Is not the genius of invention adequate to the imitation of the divine handicraft, so beautifully displayed to us in the multitudinous phases of the organs for flight possessed by the tribes of the feathered creation? I reply (for the expected contradiction will undoubtedly be given) that I am not, in the slightest degree, afraid that I (and much more able minds than my own in the investigation of nature and of physics) shall fail in the happy prosecution of this new science. I shall postpone the consideration of the important consequences of success. I shall presently allude to the geographical, nautical, and military results of such a science. I shall first treat of the materials, and then shall endeavour to show how the mechanical construction of wings is to be achieved. The natural strength of man, his sight and his *will*, are the means he possesses of directing his motions in the circumambient air; the wings themselves are to be considered as a *new mechanical power*, whereby he will counteract that gravitation that attaches him to mother earth. I have this preliminary observation to make, that when once man becomes proficient in the art of flying with wings, when experience resulting from trials shall give him a mastery in the air, and so far free him from his old obedience to the physical attraction to the earth, he may possibly prove a winged agent, able to assist the aëronaut in his balloon, so as to guide it horizontally *against* moderate currents of the atmosphere in the calm seasons of summer; in such seasons the power of the balloonist over that impetuous machine will thus not be confined to ascension and descent, but he may propose to himself a trip from London to York in a direct course, or, during calms, across the narrow channel to Boulogne from the cliffs of Dover.

The structure of wings, and the variations in the flight of birds, according to their different conformation by the master-hand of their Creator, are so well known that I shall defer my purposed elaborate description thereof, and proceed to explain what are the materials we possess for the construction of wings. First, of the feathers: these could not be procured of magnitude sufficient in a natural state, but large feathers and beautiful plumage can be made without involving too great an expense. They will be an imitation of those of the eagle and vulture; and not so costly as the plumes that decorate the heads of ladies at court, neither need they be so light, fragile, and elegant, as the court *plumassier* has been accustomed to make. Wax, common gums, glues, &c., have been and ever will be inapplicable to durable plumage; but the newly-invented cementitious matters, that gain strength and tenacity by the effect of the elements, will come in aid, when we have once discovered that we actually possess the chief requisite, sufficiently elastic, sufficiently tenacious, and sufficiently infrangible. It is with India-rubber, or caoutchouc, that the feathers I have devised will be put together, in the arrangement of long and short quills into artificial wings, as powerful as are the strongest natural wings; protecting coverts, on the patterns of the feathered race, are to be superadded; the legs of the flying animal will be supported as horizontally as are those of the bipeds of the air, by a constructed tail, wherewith to turn at will and give direction to the efforts of the arms. Plumage is not required as clothing, for vestments can be as light and warm as the clothing of birds.

The caoutchouc will be used in the putting together every component of the wings: it will be formed in long hollow tubes, through which metallic spiral springs of great power in contracting and folding the wings will run, from the clavicle and top of the shoulder to the hand and fingers, whereby the closing of the wings will be readily effected. The muscular power of the arms, subservient to the will of their possessor, will be sufficient for the extending of the wings, and for every requisite action. Along each arm, or a little above the arm, so as better to imitate the contour of the natural wing of birds, several of the hollow caoutchouc tubes will be attached. This material will be pliable at the bending of the elbow. Sockets for each feather will be placed in rotation along the tubes, wherein the metallic springs are enclosed (of steel or brass wire, as attention to the occurrence of the phenomena of electricity shall advise); and catgut will, when required, accompany the spiral wires, or, in some of their duties, supply the place thereof. In the holders or sockets the several feathers will be securely fastened, by attaching filaments, whether of silk, catgut, wire, &c.; but non-conductors, as far as possible, must be used. The threads will perforate both the quills and the caoutchouc, and other sockets or holders (as some other materials may in part answer this purpose). Experiments in the application of India-rubber will be costly, but cannot fail of success. I do not fear but that this material will prove sufficiently light, and at the same time infrangible. The weather, in all its accidents, will not injure it. It must be tested, as to its properties with regard to electricity; and I take it for granted that scientific men in that department know already all the properties of the substance. As to the heat of the sun's rays, I hold it as an axiom, that although near the surface of land and water, the plumed wings constructed with adhesions of wax in former ages were perhaps destroyed by this agency, yet caoutchouc will resist the same; and the higher the flight the cooler will be the air. The tearing of the materials, and the consequent dissolution of the wings by friction and use, can be guarded against, in the course of experiments. Man, provided with wings of great power, will not be like the half-fledged broods of the nest, the rock, and the tree, constrained to wait for their maturity of growth: he must learn and practice to fly, however, as do the callow birds. Practice will give him power to take higher flights; and reflections on a new scientific system will assist him in his experiments and trials. The wood pavement of Oxford Street, that resembles a carpet for the carriages of our gentry to travel on, has, by the application of scientific principles, partially superseded in the nicety of its juxta-position and its immovability the coarser blocks of wood which were previously tried. To form our carriage-thoroughfares of wood, almost similar in appearance to the magnificent Giant's Causeway of the county of Antrim, did not occur to those who have beheld that basaltic formation (whether it was effected by volcanic fire and crystallization, or not), but the resemblance of the hexagonal wood pavement to that natural causeway, in its horizontal strata, is very striking. That it has for ages been denominated a causeway, or *chaussée*, as the French term certain highways, may have possibly, however, furnished some idea, to some one of the projectors, of a road of wood of that identical formation. The apparent imitation, at all events, furnishes to myself, who have often been lost in admiration of the wonders of nature on the north-eastern coasts of Ireland, with a hope that my invention of wings may be equally felicitous, and as serviceable a copy of nature.

However great the fear of breaking our necks, another cause of trepidation may have had as great an influence in deterring speculative as well as practical *artists* from the inventing of wings, *viz.* the fear of becoming a laughing-stock to the public, as if natives of the island Laputa, and taught in its school of philosophy; there has nevertheless among poets and painters existed a considerable willingness to allude to wings applicable to the human frame. It formed a portion of the poetry to be found in ancient mythology; Mercury had a strange kind of pinions to his heels, the horse Pegasus bore wings; and the relations given of the winged experiments of Dædalus, or his son, are supposed to have some *reality*. Of this latter circumstance, as well as the nearly successful trials by some modern mechanists, I shall hereafter treat more at large. There is a *beau idéal* also in our early impressions, as to all that relates to the wings of the angels and messengers of the Almighty, and of cherubim and seraphim. In poetry, it has ever been thought elegant to attribute organs of flight to an Ariël and the creations of fancy and fiction. Generally speaking, it is a favourite idea that wings are of a brilliant white plumage: the solemnity of a raven plumage will be in better accordance with the species of manufacture which my proposed materials will enable us to perfect. Ordinarily I believe India-rubber is converted, when fine, to a black hue. Painters, in many of their most splendid works, furnish us with their idea of wings; the shapes in which they have indulged their fancy are worthy of study; but, radically, they have misled our thoughts as to this subject, for they depict large elegant wings and smaller pinions, distinct and separate from the arms. Now the muscular vigour of the human arms affords the chief momentum for application in this novel construction, and the arms, hands, and fingers, are equal to all the varied actions of folding and unfolding the wing. Created forms point to this natural idea for the construction; all the feathered tribes are, excepting in the shape of wing, bereft of arms.

I imagine, notwithstanding the remark that I have just made on the subject of wings detached from the arms, that such can be made, a variation only being requisite in the arrangement of my materials, and a complicated machinery, of which the fault will be an *addition of weight*. The merits of detached wings are, the far greater elegance of which they are capable, also the arms and hands, being unfettered agents, can better assist in the folding and closing, in the same beautiful manner as birds lay their wings to their sides; and this folding up of the wing, out of the way, will perhaps with difficulty be effected by the natural process of attachment to the arms. It will be found necessary that the wings fixed to the arms should be attached only from the nape of the neck and shoulder-tops as far as the ulnæ, and that below the elbows the lower arms and hands should be at liberty. Until I am enabled to make experiments, it is impossible to surmise which of three sorts I allude to in this Essay is the most probable of ultimate success. Detached wings I consider the most doubtful, and complicated; but if they can be formed by a light and beautiful mechanism, they will be the most desirable; half the fatigue to the arms will be avoided, and more continuous flights made. They would prove more costly than other wings; and the cheaper form I shall describe in speaking of the bat.

I shall here speak, first, of the various use of caoutchouc, and of other materials, for the purposes in question; secondly, of wings or processes of other shapes and constructions. These topics are intimately blended in their nature, and I shall therefore combine my observations relatively to them. I shall be excused for writing this Essay before proper experimental research; the nature of the object has compelled me to reason and cogitate, rather than set about the construction. I know what odium I am obnoxious to, if the manufacture shall be found impracticable. I am aware, too, of a happier celebrity if I succeed, and gain over to my cause the enlightened assistance and counsels of the mechanists of this enterprising age. I have admired the wonderful productions of Maillardet, whose automata breathe and move, and *seem* to be actuated by moral sentiment, and to be themselves artists of considerable merit, although inanimate. I have read of Vaucanson, of Archimedes; and the histories of various great mechanicians, ancient and modern, and of their *collaborateurs*, the mathematicians and astronomers, are familiar to me. These I only allude to, as multitudes of students are well acquainted with them; nor need I enlarge upon the wonderful inventions of steam and steam-boats, railroads, or of gas (which we may consider a modern Greek fire), of electricity, and chemistry. These successes, though more foreign to this Essay than the science of the aëronaut, encourage me; I affirm that greater things have already been accomplished by scientific investigation, and the admirable ingenuity of the human mind, than would be the act of flying. Let it be granted, that a spark of that highly estimated gift to man, genius, sometimes originates inventions in science of the utmost moment; and that he who advances the first principles of a great discovery, however simple the *principia*, and however efficiently the inventor is seconded by other men of learning and science, has a right to claim honour. We acknowledge Columbus to be the discoverer of a western continent, notwithstanding the original immigration of mankind thither, and the affinities of the American race of men to the other ancient nations of the earth. It has mostly been the case, in inventions of especial service to mankind, that original *principle*, founded on reason, has been simple. The most famous men in science have been distinguished for simplicity of manners, and often of mind. Genius, as a gift from heaven, is the twin sister of reason.

Of my chief material, India-rubber, or caoutchouc, the applications are multitudinous. I have not had resources wherewith to make proper experiments; any experiments would have endangered a proposed process to be remarked, and so have deprived me of the character of the original inventor, which I fairly claim, as I have never read or heard of these ideas being formed by any one. Having risked blame if my plan is irrational, I consider it right that, if my plans succeed, I should have the reward of being recognised as the inventor. I seek for no patent, I wish to secure nothing for myself; but if these ideas are not fraught with folly and nothing besides, and if a fair consideration be given to the subject by persons addicted to science, I am confident that I shall be enabled to prosecute the requisite experiments. I assert that the appliances of caoutchouc to my object are various. I have spoken of tubes with cups or sockets intimately formed (for the reception of the greater feathers) in the substance of the India-rubber tubes; or the said sockets to be safely attached to the tubes. Thin sheets of elastic gum or caoutchouc may also receive the feathers down a certain length, more or less, as advisable, and enclose them tenaciously; these will possibly be very serviceable as to the smaller feathers, but the action on the wind of all the feathers must be free. Bladders of a delicate texture, containing rarefied air, may help to *support* the flyer, as bladders of common atmospheric air support the swimmer: many such secondary inventions will be found useful when making the experiments. The chief material, caoutchouc, when liquid and hot, will possibly receive the feathers with strong and lasting adhesion. Silks may be serviceable in portions of the wings, that they may be as light as possible. Whalebone filaments or shreds may be found a cheap resource in the manufacture of the feathers, or caoutchouc or whalebone branches, with the most approved cements, and with ligatures of the most tenacious and infrangible thread or wire. Lightness is the great requisite.

Feathers are not the only component of wings indicated to our inquiry by the Divine Master of animated nature. A membranous wing may be formed of thin-laid caoutchouc, of silk, of parchments. I shall have therein to imitate the structure of the wings of bats, which are continuous, and more like webs than feathers. There is no reason why wings of feathers may not be serviceable for some objects, in the art of flight; and wings of membranaceous construction serve better for other purposes: some in certain states of the atmosphere, and others in other seasons. The question of a tail to aid in flight is subordinate; the *possibility* of wings being employed virtually embraces the *entire* question; and that conceded by men of science, all the rest of the minor inventions and applications follow as a consequence. The wings like those of the bat, or of the vampire, which is fabulous, or of the dragon, nearly as fabulous, will not be esteemed the least amusing part of my invention; these will better suit the form of the arm and elbow, as being too stiff to bend in reiterated action to the back of the head and body, and subject to fatigue in the use of wings derived from the imitation of birds. I hope that this idea may lead my readers to such a state of good-humour, in the recollection of the strangely imagined winged people in "Peter Wilkins," as illustrated with something of a boat-shape, in the engravings to that droll work, that I may meet with a less contemptuous reception of my theories, since I am free to confess that the idea of wings and of flying has in all ages been laughed at, and has perhaps failed because of their provoking to laughter. We must not forget, however, that laughter is itself an absurdity, and sometimes a folly.

If either of my notions of wings is within the scope of experimental invention, if one or both shall prove successful, my immediate object is achieved; and ultimately this science will be matured.

On the question of peril, the loss of life, and the fracture of limbs, much should be said. Adventurous man does not bind himself to the observance of the admonitions of fear and of prudence. I shall only say that practice must begin by small flights, flitting with an horizontal rather than a vertical direction. The utmost precautions must be used to avert dangers from the volunteers who shall first essay *their wings*. Even when they *can* fly, they must keep to bounds known to public expectation, or the fowler's gun may chance to maim them. In the course of time, not only that danger, but most others, will not attend the *rara avis*.

I have many ideas of invention, which I believe have never been contemplated by any one, for the guidance of balloons through the pathless air. I say nothing at present of those inventions to come in aid of the aëronaut; first, from respect to my intrepid neighbour, Mr. Green, who has, I believe, invented means for accomplishing that important object, and with which I am as yet totally unacquainted. I have, secondly, alluded to the perils which any man flying must encounter, until he shall be master of the art; and speaking of balloons, I shall therefore confine myself to two observations. It must be at a very advanced stage of the art of flying that a winged passenger can dare to take his stand on a foot-board attached to the car of a balloon, and at times when the current of air admits, or the voyage to a fixed destination of the aëronaut, shall require him to fling himself from an aërial station, expand his wings, and with ropes attached to a belt round his waist, like a hoop, that cannot tighten so as to suffocate him, and also to the balloon, by fits and starts (flying, and when weary resting on his foot-board at the car) drag the unwieldly machine after him. A calm day, or moderate breezes, alone would admit of his being of use in steering a *course:* his flight would be beneath the car, with wings and tail expanded; and his efforts would at once tend to diminish the too-great elevation to which the aëronaut must ascend (unless the balloonist dismiss the gas or preserve the ballast of sand), and guide the aëronaut against any moderate wind or current of the atmosphere. Of a sail, a rudder, and some other extraordinary inventions, I may perhaps be tempted to speak in another Essay. Of these, my idea for a rudder is the chief, and I believe its nature has never been contemplated; it, as well as my wings, must abide the test of experiments. Nervous suspension of the powers of action, I hope, will yield to a just confidence after minor trials by those flying. My second remark is, that I believe the man flying with wings can be provided with the accompaniment of a small balloon of that exact degree of power of ascension, that shall equal his own personal weight when equipped for flight;—that is to say, be an exact counterbalance to the gravitation to which all matter is subjected in proportions known to science. This additional means he might have, by various methods, entirely under his control, so as not to let his auxiliary engine escape from him: the muscular strength of arm and the mechanical power of wing will be then sufficient to make a descent. Whether this object can be attained is also a matter for experiment, and it appears that small bladders are a more plausible and more feasible idea. I believe that a great ballon is sometimes suspended for the aëronaut's purposes at a height of thirty feet or more from the ground, and temporarily secured by ropes; an occasion of this kind will enable the flyer with wings to continue his experiments. The bat has tiny claws at the extremity of the wing, serviceable in taking hold of any support, as well as in grasping its prey. Whether with wings feathered or webbed, the hands of the man will be similarly situated, and serve greatly to give him security in all trying moments.

I am sensible that I have trespassed on the patience of scientific readers in this development of the materials for, and the construction of, wings; I therefore defer a more elaborate detail of the nature of those materials and of their application. I shall conclude this first Essay on my invention with a concise enumeration of many of the more important advantages which we might hope to derive from obtaining the power to fly. Each of these I shall speak of as succinctly as possible. The reason I state them is, that they will perhaps be considered as desiderata of so great moment, that I may happily call the attention of learned societies, possessing the means of making experiments, and the talent to appreciate all proposals of scientific purpose, as either feasible and useful, or as being foolish and fallacious, to the consideration of this Essay, on account of the benefits that may accrue from success in the experiments.

The art of flying, if prosecuted to *any* degree of success, must be a source of information to the active, daring, and intelligent aëronaut. In its ultimate results, if complete success should be obtained, it will be a powerful aid to the kindred science of aërostation, and they may go hand in hand in the prosecution of geographical discoveries. For some years, little can be hoped for, but a minor degree of success; every additional method becoming the result of laborious and perilous practice, and to be gained by an outlay of considerable sums of money. To fly through the etherial fluid from city to city, and across broad rivers, could be the occasion of performing considerable services to society. The ascent of mountains, fatiguing to pedestrians, and in some cases impossible, will be an object of consequence in various researches of science, to the geographer, the geologist, the botanist, and in many other important inquiries. Not only trigonometrical surveys of provinces and extended tracts would be rendered more rapid in their completion, but surveys of coasts and rivers for nautical science would be equally facilitated, if any proficiency in the use of wings is ever to be attained. The admeasurement of land by surveyors, for civil purposes, will be easy and at a less expense. Buildings can be examined, both as to their architecture, and their state of security. Such rivers as the Nile and the Niger, whose sources or whose embouchure were so long a problem, veiled in the obscurity of imperfect science, would have been earlier explored. Maritime discoveries will be greatly promoted. The whereabout in such waters as the Straits of Magellan, in which our most intelligent and scientific navigators had to brave the fury of all the blasts of that stormy region, could have been readily ascertained: an exploring squadron, laying down the coasts and currents, might have, at the same time, discovered something of the nature of the inland region of that *terra incognita*, Patagonia, or enabled one of the officers of an expedition to ascend the hills of Terra del Fuego, and thus have shortened their labours and averted much of the danger of shipwreck. So, in such a quarter of the unknown regions of the earth as Baffin's Bay, the existence of Melville Island as such, and the ascertaining whether land beheld from the deck were continental or insular, would have been learned or rendered facile, and Parry, Franklin, and Back might earlier have shaken hands. When a promontory could not be doubled, somewhat of the nature of its extent, and of the waters surrounding it, could have been gained. In our wars in distant lands, the course of rivers, as in the case of China, could be partially investigated; a good flyer would prove an especial good spy. In Europe, or in India, fortifications, about to be attacked, could be previously examined; or an enemy's camp investigated: as to warfare, I shall add little, and civil purposes are better and more immediate incentives. In navigation, the invention would be fraught with the happiest consequences: let us reflect on the position of a noble ship, with a gallant crew, fast to some sand-bank or reef, and that possibly a stout rope carried to the ship might save the lives of all, and even the vessel itself; the distance from the shore might be too far for the means of salvation by Capt. Manby's projectile—life-boats might be unable to stem the surge, the spot might be under a beetling cliff, without any hope of timely communication with the rocks beneath, in some of these cases (when the *use* of wings is known, and their power ascertained) much good in the cause of humanity would be effected; for a brave man could fly to the rescue. Messages important in national concerns might occasionally be transmitted, where a telegraph is not at command; or where a besieged garrison is cut off by the enemy's works from communicating with an admiral approaching to its relief; and in other cases, when immediate news is material. To cross a frith or a rapid river, is also a thing of much importance. In the new colonies of Australia, &c. the march of geographical knowledge would be considerably accelerated. In affairs of commerce, also, the use of wings might be profitable. Along the shores and cliffs in all parts of the world, there are items of value, that would be readily procurable; eggs of sea-fowl, the down of the eider-duck, and multifarious objects useful as esculent provisions, or valuable in trade, could be come at. The birds themselves would be procurable for the relief of a crew of starving mariners. All this I know supposes the possibility not merely of having wings, but also good wings, and not too expensive: there being a pair of them placed at the disposal of circumnavigators. As to the extreme peril of flitting past the surface of perpendicular crags to explore the nooks and recesses thereof for the capture of birds and their eggs—would the danger be as great as that to which the adventurous inhabitants of many of our coasts expose themselves when descending the same frowning cliffs by means of a rope? Geological and other museums for objects of natural philosophy may receive great additions. There is much more for me to say, in every section of this *serio-comic* Essay, but I shall defer it for a moment of revision, if it shall ever happen that wiser minds than my own should be tempted, after a mature consideration, to encourage me by the little-to-be-expected reply to me, that my present argument is not one of superlative folly; but that it admits of being entertained. I confess I have little hope of such a result, and shall now take the question *ad referendum*, and think of experiments and more precise inquiries.

In conclusion of this Essay, which is but a preliminary statement of the nature of a possible invention, I am compelled humbly to plead excuse for my, in a manner, begging the question on so many important particulars relating to the same. I have plainly stated that I submit my own enthusiasm of hope unto the more practical experience of able mechanical philosophers (who have, almost professionally, advantages which are not within my reach, either in point of leisure from my daily avocations or of requisite resources wherewith to pursue the investigations). I humbly anticipate that the ultimate opinion of impartial men will be in accordance with the proœmium of my present Essay, that in pointing out efficient *materials* that are admirably calculated for the artificial manufacture of wings, I have performed half the duty of an inventor. The idea is directly mooted; it remains to be seen whether it is a sane conception or a folly. In my next essay on this subject, I shall consider all the allusions in the literature of antiquity bearing upon the devices of the old Greek inventor of wings, which, although ~~it was~~ fatal to one or more~~, some~~ ingenious artists, have handed down the name (*Dædalus*) of one of the family that embarked in this speculation (in conjunction with his other inventions) as the father of Grecian art, and the prototype of artificers,

> Humano capiti cervicem pictor equinam
> Jungere si velit, et varias inducere plumas,
> Undique collatis membris:—

In this exordium of one of the most elaborate disquisitions on art, which, under the title of Art of Poetry, embodies the most sensible instructions upon the entire mysteries of authorship, friend Horace warns me that the *Piso'nes* will not refrain from laughter. Further on, in the same exquisite poem, he treats of the invention of new words in language, praising especially hose, as privileged, which 'Græco fonte cadant;' and our technical dictionaries exhibit their reliance upon the vested prescription of Hellenic—for if chemical discoveries, &c. require a *name* (although a substance was but yesterday discovered by analytical process), it is immediately decorated with a Greek appellative; Horace confesses, however, that the felicitous combination of known words, or the converting of some to a new application in the ideas they are made to represent, is equal to a *genuine invention* of neologists. With us moderns, the reverse of this process holds good, for it is the chief care of a judicious writer to avoid the corruptions in language, which the flow of a false and vapid species of poetry and romance has superinduced in our own classical language, that once rivalled in energy and precision of diction the most renowned idioms of antiquity, and rather to return with the ebb of tide to the primary meaning of every word in its derivation from the learned languages. All this is applicable as an argument in favour of my assertion, that as the felicitous adaptation of known epithets to new combinations of idea is hailed with so much praise by the censor Horace, the favourite poet of most men of taste, so also it is equally permitted to me to consider in the light of *real invention* the application of materials that are ready to my hands, and, although so convenient, not very expensive, to the construction of artificial wings. I profess to point out which are the materials; man is incapable of creating them, and raw material is not within the compass of invention. The art of flying is a new *science;* and I trust that scientific men will be predisposed to estimate it as an object highly worthy of laborious inquiry. I purpose to give the natural form and construction of wings, with all their details, in drawings or diagrams; to investigate the principles of the power of flight as enjoyed by the genera of one of the great kingdoms of nature, reckoned subordinate to the animal creation, yet possessing very considerable advantages over quadrupeds and bipeds. Such portion of my inquiries admit of being deferred, for surely it will be conceded to me, and I make it a postulate of the proposed science of which I am laying down first principles, that the ingenuity of men of science is quite equal to the proposed imitation of natural wings by the means of mechanism and art. Here I must again allude to the chief difficulties, fatigue to the muscles of the arms, and inability to rise from the ground. I am aware that the apparently insuperable difficulty to the sufficient action of wings, is the deficiency of muscular endurance in the human arms, to which I have chiefly wished to attach the artificial wings; also their inability to support a movement from back to front, the positive fatigue that will be incurred by the requisite action. If a semi-rotatory action of the wings can be gained by a perfect combination of mechanical devices, which a ratchet-system can enable the flyer to revert and regulate, so as to regain *instanter* his power of catching the breeze, it may be an advisable addition. The support and the power of progression must be determined by experiments, and above all, the efficiency of the materials which I propose, is the soul of this invention. That the fatigue which threatens the upper limbs of the body can be averted by shard-like processes, I am ready to allow, when an attachment down the sides to the thighs and legs, with bands surrounding the waist, shall be considered proper: this resembles in some degree the idea in "Peter Wilkins," but such contrivances might fetter all free action of the wings, and the 'shard-borne beetle' possesses little of elegance. Now, if a man flies, he must be fashioned so as to be fit to be looked at; we fall in love with novelties, but not with ugliness. It is much easier for me to overpower the gravity of countenance in those who peruse my pseudo-philosophical Essay, than to prevent the specific gravity of a man, lifted by wings into the regions of air, from bringing him to the ground with a fair back-fall. So difficult a task as it must ever prove to carry into execution the act of flying, as a human effort, involves the necessity of many subordinate contrivances, that will occur to ingenious artists. In the most certain of arithmetical and mathematical sciences, further theorems admit of demonstration only because prior problems have been resolved. Thus it was that Euclid invented; and thus Sir Isaac Newton progressed. The fatigue to the brachial muscles is the naturally insurmountable obstacle; naturally we cannot fly, yet that it is no matter of absolute despair may be collected from laws of ratiocination and comparison. How long did not the numerical amount of the powers of mechanics remain confined to *only* five or six? These, which appeared to be the only possible *powers* of that science which constituted the sole action of men over the material world, have been *added* to; and no one will deny the fact. The means (when recognised) to gift the arms of man with a continuous effort to sustain flight, may appear very simple when we shall have devised them. One method may fail, and another again may be frustrated by some unforeseen hindrance, to be overcome just as the impediment of friction has been nullified by the genius of mechanics. A perpetual motion was long considered (like the philosopher's stone) a discovery not to be effected by mankind; yet so great an approximation has been made to the discovery of perpetual motion, by the refined mechanical talent, that the *desideratum* has been virtually supplied, and nothing but the perishable nature of matter prevents our asserting that it is well-proven: *mortalia facta peribunt.* It appears to me likely that a coriaceous armlet, or one of caoutchouc, by a due *rest* against the sides, will prop the arms when lifted for the agitation of wings or flight; this case must also be pliable; it will not surround the arm, but attach itself by bands around it; fix by a button or slide to the separate, though similar, cincture round the waist, and remain as a firm support to the elevated brachia: when the wings are to be closed, or taken off, alighting on the ground, this covering of the arms, being unfastened at the button or slide, can be turned, and so be totally released from the breast-plate. The arms being rendered capable of remaining raised, for the open wings, have only therefore to perform the evolutions of flight, which will thus be easy and gentle. The particular beat of wing upon the air I recommend to be downward, and undulating in the strike. Of this we can with the eye observe the model of action in a beautiful British bird of considerable size, well known to ornithologists, and which might be termed a *flapper*. Its circumvolutions in the air, and its great mastery over its specific gravity, are easily recognised. Some difficulty, in the shape of the human brachia, as not applicable to the highest and thickest portion of the wings of large birds, is to be remedied by placing the arm (in a degree) slanting to the wing (not exactly diagonally): the hand will thus be more central to the expanded wing, and the lower arm being free from the newly superadded member, can arrange every portion of the feathered structure, in the way that birds, with their bills, settle, arrange, and prune their feathers. Moreover, I have said that half the action requisite to flight may be performed by a fine machinery. The wings can have so great a power, as to be able to carry all the weight required; and their size will have the more imposing effect, and excite the greater admiration. I do not acknowledge that the body of birds is at all more fitted by natural form to receive the endowment of wings, than the human frame. The wing itself, in birds, may have much stronger sinews than have the arms of men: the deficiency of sinews and tendons can be remedied by artificial means. If I prove the *principle* that wings calculated for flight can be made, the *amount* of power may be increased at will. The power of the lever varies according to the relative distances of the weight, and the acting power from the fulcrum. The power in that simple engine is sometimes but twice (sometimes much) greater than the momentum required. So it may be with artificial wings; and the mechanical buoyancy to be gained, while in the air, I have already treated of. As to the perils of the undertaking, men have courage to despise them—witness the repeated trial of balloons and parachutes, and the contempt of fearful accidents in steam-boats and on rail-roads. I lament, with that feeling of humanity which becomes a well-disposed mind, that hitherto unknown dangers may eventually be added to the catalogue of human accidents, in carrying out the principles of this new science into actual experiment. I shall require time, owing to the limited means at my command, to investigate, and set down in order, the correllative appliances whereby to attain my object. I lament this delay, but trust (if the idea is not reckoned visionary) that men of enlightened mind, in the departments of science and art, will aid in some degree, by pointing out what occurs to them for our guidance in so pathless an inquiry. Among the investigations that I am engaged in, are the means which the absolute perfection of modern machinery (notoriously overcoming much of the obstruction of friction) places at hand to gain a momentum, for the chief object of rising into flight; and by newly-devised movements, similar to chronometrical improvements, in some cases to wind up the springs of flight by wings, without always leaving the burthen of gravitation, and of atmospheric resistance, upon the muscular power of the *flyer ;* for the retention, and the occasional abnegation, of such power might bring life into peril—which to avoid, as far as possible, it is a duty of science to provide for. I have (rather playfully) alluded to the vesicatory means of enabling the aëronaut to gain the power of suspension, or resistance to gravitation, by rarefied air. The natatory process of fish, which the Almighty power invented (in their favour) to overpower the physical circumstances of the world of waters, must be closely studied, and can perhaps be successfully imitated. A breast-plate of caoutchouc or other bladders inclosing rarefied air, will be an *appui* to the flyer, and will save him from bruises. It must be so delicately contrived as not to impede the action of his wings. I have no hesitation to declare, that, supported and assisted by the genius of mechanism, in which Maillardet exhibited his admirable creations, my wings will be found to possess an absolute power of flight.

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